Journal of the Royal Society of Arts

NO. 4990 FRIDAY, 9TH NOVEMBER, 1956 VOL. CIV

FORTHCOMING MEETINGS

TUESDAY, 13TH NOVEMBER, at 5.15 p.m. COMMONWEALTH SECTION. '*Chemistry and the Sugar Cane*', by Professor L. F. Wiggins, D.Sc., Ph.D., F.R.I.C., Director of Sugar Research, Department of Sugar Chemistry and Technology, Imperial College of Tropical Agriculture, Trinidad. Sir John Simonsen, D.Sc., LL.D., F.R.I.C., F.R.S., a Member of Council of the Society, in the Chair. (Tea will be served from 4.30 p.m.)

WEDNESDAY, 14TH NOVEMBER, at 2.30 p.m. '*The Commissioning of Works of Art*' by Louis Osman, B.A.(Arch), F.R.I.B.A. F. A. Mercer, Hon.F.S.I.A., Editor of *The Studio*, and a Member of Council of the Society, in the Chair.

WEDNESDAY, 21ST NOVEMBER, at 2.30 p.m. '*Quacks Through the Ages*', by A. Dickson Wright, M.S., M.B., F.R.C.S., immediate Past President, The Medical Society of London. Sir Charles Dodds, M.V.O., M.D., F.R.C.P., F.R.S., Courtauld Professor of Biochemistry, University of London at Middlesex Hospital Medical School, in the Chair. (The paper will be illustrated with lantern slides.)

THURSDAY, 22ND NOVEMBER, at 7.30 p.m. FILM EVENING. (See programme below.)

MONDAY, 26TH NOVEMBER, at 6 p.m. The first of three CANTOR LECTURES entitled '*Engineering Electronics (excluding radar and Service equipment)*' will be delivered by L. E. C. Hughes, A.C.G.I., D.I.C., B.Sc.(Eng.), Ph.D., M.I.E.E. (See syllabus on p. 956. The lecture will be illustrated with lantern slides.)

WEDNESDAY, 28TH NOVEMBER, at 2.30 p.m. ALFRED BOSSOM LECTURE. '*Air Conditioning of Buildings*', by J. S. Hales, B.Sc., A.Inst.P., F.Inst.F., A.M.I.H.V.E., Director, Heating and Ventilating Research Council, and Director, Industrial and Domestic Development Laboratories, B.C.V.R.A. Sir Howard Robertson, M.C., A.R.A., P.P.R.I.B.A., S.A.D.G., in the Chair.

THURSDAY, 29TH NOVEMBER, at 5.15 p.m. COMMONWEALTH SECTION. '*London House*', by Brigadier E. C. Pepper, C.B.E., D.S.O., D.L., Warden, Dominion Students' Hall Trust. Sir Harry Batterbee, G.C.M.G., K.C.V.O., in the Chair. (Tea will be served from 4.30 p.m.)

SYLLABUS OF CANTOR LECTURES ON 'ENGINEERING ELECTRONICS'.

LECTURE 1. *Monday, 26th November.* History, definitions, sources of information. Electronic sources of radiation; flashers, discharge lighting; X-rays in medicine and industry. Radioactive sources, measurement and uses.

LECTURE 2. *Monday, 3rd December.* Release of electrons; photo-electronics and applications; smoke control, counting, safety guards, readers for computers. Mosaics for television; transistors. Thermionics, valves, cathode-ray tubes; industrial television, rescue equipment.

LECTURE 3. *Monday, 10th December.* Electronics in industry. Control of machine tools by electronic computing; full automation. Computers in office and research; random number machine.

Fellows are entitled to attend any of the Society's meetings without tickets (except where otherwise stated), and may also bring two guests. When they cannot accompany their guests, Fellows may give them special passes, books of which can be obtained on application to the Secretary.

FILM EVENING

The first Film Evening of the Session will be held at the Society's House on Thursday, **22nd** November (not 27th as stated in the sessional programme) at 7.30 p.m., and the following two films will be screened:

The New Explorers

Give Us a Ring

The New Explorers (50 minutes), which is in Eastmancolor, was produced by World Wide Pictures Ltd. for the British Petroleum Company. It consists of a number of episodes 'shot' in the Persian Gulf, Canada, Zanzibar, Papua, Trinidad and Sicily, and illustrates by a series of changing backgrounds the stages in the search for oil. The film will be introduced by Mr. James Hill, who was its writer and director.

Give Us a Ring (26 minutes) was made by the Film Producers' Guild for the British Electrical Development Association, and describes, in a light-hearted way, the advantages of a new electrical wiring system, the 'ring circuit', in providing sufficient plug points for the increasing number of electrical appliances to be found in the home nowadays. Lloyd Lamble takes the principal part of an architect who knows nearly all the answers. This film will be introduced by its Technical Director, Mr. Philip Honey.

Tickets are not required and Fellows are invited to bring two guests. Light refreshments will be served in the Library afterwards.

PERILS AND PROSPECTS IN TOWN AND COUNTRY

As was announced in the *Journal* for 26th October, the Conference on 'Perils and Prospects in Town and Country', was held in the Lecture Hall on Wednesday, 31st October, 1956. A full report of the proceedings will be published in the *Journal* for 21st December, 1956.

REPORT ON THE SOCIETY'S EXAMINATIONS FOR THE SESSION 1955–1956*

INTRODUCTION

The Centenary of the Examinations of the Royal Society of Arts has just occurred, and in this introduction to the Annual Report on the examinations in 1955/56 I would like to give a brief summary of the growth of what is now a very important part of the Society's activities.

Throughout its long and distinguished history the Society has fully lived up to its title of The Royal Society for the Encouragement of Arts, Manufactures, and Commerce. When it was founded in 1754 there were few of the now numerous organizations functioning for the public good, and the Society had almost unlimited scope for the fulfilment of its aims. By the award of premiums and medals and the organization of exhibitions and so on, it encouraged and helped in the development of the 'polite arts', mechanics, agriculture, manufactures, chemistry, the colonies, and trade. It was only to be expected, therefore, that, when the general interest in education began to develop about the middle of the nineteenth century, the Society helped in its development through the organization of exhibitions, conferences and similar activities, and by the institution of its examinations in March of 1856, when examinations as such were a novelty.

Actually, the first examination mentioned in the Society's records was in 1783, when a medal was offered to 'the master of any academy or school for boys, within thirty miles of London who, within three years, could teach the greatest number of scholars, not less than four, to write and speak Latin'. This was awarded in 1787 to Dr. Egan, the Master of the Royal Park Academy, Greenwich, and silver medals were awarded to each of the team of five boys whom he entered for the examination. Another Gold Medal was offered for the teaching of German, Spanish or Italian, as these were 'commercial' languages not usually taught in English schools. But, unfortunately, there were no claimants for the modern language medals, otherwise the centenary of the examinations might very well have been celebrated in 1886 or 1887. But the origin of the present system of examinations came about in the following way.

In 1848 a number of the Mechanics Institutions which were then developing in all parts of the country were allowed to join the Society, so that their members could enjoy some of the privileges which it had to offer them. Then, in 1852, the Society went still further and organized a Union of Institutions, with the Society providing a central organization for the distribution of general information, lists of lecturers, and so on. Annual conferences were held each year until 1875, where common problems were discussed. Perhaps these conferences were the forerunners of the many thousands of conferences on educational matters

* A fuller report, containing lists of prizewinners and medallists, and the individual reports of the Examiners in the various subjects, will be published as a separate pamphlet by the Examinations Department later this year, and a copy may be obtained by Fellows on application to the Secretary.

that have since been held. The most important outcome of the Union of Institutions, however, was the establishment of the Society's examinations, which were originally intended for the benefit of the members of the affiliated bodies.

In 1855 a very elaborate Programme of Examinations was prepared in Mathematical Sciences, Experimental Sciences, Science of Observation, Mechanical Sciences, Social Sciences, Fine Arts, Moral and Metaphysical Sciences. It is interesting to note that this very first scheme was on similar lines to the system now used by the Society; the papers were to be set by a board of examiners and distributed by post to local committees which were responsible for the proper conduct of the examinations in various parts of the country, the worked scripts to be returned to London and certificates issued by the examiners there. But there was only one candidate, and the scheme was cancelled.

In the following year a revised and less ambitious scheme was prepared, and examinations were offered in the subjects of Mathematics, Book-keeping, Mechanics, Chemistry, Physiology, Botany, Agriculture, Geography, English History, English Literature and Composition, Latin and Roman History, French, German, and Freehand Drawing. The examinations were partly oral and were held in the Society's House in London, as it was felt that candidates would be attracted by the privilege of meeting a distinguished panel of examiners. Fifty-two candidates attended and, between them, worked 203 papers. Each candidate had to take at least two subjects, and also a preliminary and qualifying examination in handwriting and spelling; two of them failed in the latter, and one wonders what would be the effect of such a preliminary test to-day.

In 1857 the examinations were held in Huddersfield as well as London, under the control of examiners who had travelled there for the purpose. It was clear, however, that it would be impossible to send examiners all over the country, and in 1858 an amended scheme was introduced which was similar to the scheme first suggested in 1855, but with different subjects of examination, and which required written papers only, at centres in various parts of the country under the control of specially appointed local committees. Over the years the scope of the examinations has been modified to meet the changing needs of the day, but the present system remains much the same as it was in 1858, except that the local education authorities have now taken over the work of the local committees.

There have, of course, been the usual ups and downs that are common to all pioneering schemes. In 1870 and also in 1882, it was decided that the examinations should be discontinued, but on both occasions there was a reprieve. In 1871 examinations were instituted in what was then the entirely new field of 'technological subjects', and these were later handed over to the City and Guilds of London Institute on their foundation in 1878. In 1882 it was decided to concentrate on examinations in general and commercial subjects, and this is still the main policy of the Society; examinations were then held in Music and Domestic Economy as well, but these have now been dropped.

The new scheme of 1882 was instituted at the insistent request of the Institutions in Union, but it was then decided that the Society could not continue

to defray the expenses of the examinations, and that an entrance fee of 2*s.* 6*d.* per subject should be charged to all candidates. This removed the special conditions previously enjoyed by members of the Institutions in Union.

Thus began the present series of examinations which, in the course of seventy-odd years, have expanded to proportions which would have seemed fantastic to the originators. 695 papers were worked in 1882, as against 183,299 papers in 1956. At first the progress was slow, although in 1900 the number of papers worked was 10,000. Since the turn of the century, however, and the introduction of three stages of examination, the numbers have increased by leaps and bounds. The Society has also introduced examinations for the award of School and Senior School Commercial Certificates for pupils of day schools with a commercial bias; and Grouped Course Certificates in commercial and technical subjects for those attending junior evening institutes of the London County Council, which have now been extended to institutes outside London. From time to time the Society has been asked to undertake a number of special examining tasks, some of them of very considerable importance. An interesting development has been the introduction of examinations for the award of Teachers' Certificates in Shorthand and Typewriting; the Certificate does not, by itself, entitle its holder to be regarded as a qualified teacher, but it is accepted by the Ministry of Education, and by local education authorities in all parts of the British Isles, as a teaching qualification in that particular subject.

In the early years, prizes in various subjects, or groups of subjects, were contributed by many notable persons and institutions; Queen Victoria annually maintained a prize of 25 guineas, instituted by the Prince Consort, for the candidate who obtained the largest number of first-class certificates in four consecutive years. In 1883 the offer of prizes was discontinued, but in 1891 the present system of medals was introduced, in order to attract not so much a greater number of candidates as a greater number of *good* candidates.

The Society has sought, and very readily obtained, both local and national co-operation in the central organization of its examinations. The Examinations Committee includes representatives of central and local education authorities, the teaching profession, and professional bodies concerned with commercial subjects. There are also a number of Advisory Sub-Committees for various subjects, or groups of subjects, and for special examinations.

It may reasonably be claimed that the examinations of the Society have made a significant contribution to the extension of general and commercial education in this country. Not only have they provided an educational incentive by means of which hundreds of thousands of students (principally, but by no means exclusively, those attending part-time courses) have been encouraged to rise to higher levels of knowledge of cultural and vocational subjects, but they have also established reliable standards of attainment in general and commercial education which are now widely accepted and utilized by employers in recruiting staff and in implementing schemes of promotion. The present demand for these examinations would seem to imply that these two needs have never been more greatly felt than to-day.

To mark the occasion of the Centenary of the first examination conducted by the Society in 1856, the Council have approved the award of special Centenary Prizes to candidates submitting the best papers in certain subjects, or groups of subjects, at the combined Easter, Whitsun, and Summer Series of 1956. The successful candidates will be awarded specially inscribed certificates in addition to the cash prizes.

EDWARD CROWE

ENTRIES AND PAPERS WORKED

The following table gives a detailed comparison of the subject entries for the various examinations conducted by the Society in the Sessions 1955–1956 and 1954–1955, and also of the papers worked:

Examination	*Entries*		*Papers Worked*	
	1955–1956	1954–1955	1955–1956	1954–1955
Ordinary (Single-Subject)	153,173	142,622	145,393	135,374
School and Senior School Commercial Certificates	16,398	14,952	15,822	14,611
Oral Tests	4,551	3,465	4,191	3,244
Grouped Course	16,201	12,961	14,339	12,264
Teacher's Certificate in Shorthand	618	652	594	630
Teacher's Certificate in Typewriting	413	403	406	389
Road Transport Subjects	1,256	1,142	1,169	1,044
British Transport Commission (Preliminary Examination of Candidates under Apprenticeship Schemes)	1,146	1,976	1,141	1,874
British European Airways (Special proficiency tests in Shorthand and Typewriting) ...	117	128	117	128
Royal Air Force Administrative Apprentices (Scheme of endorsement of certificates awarded by the Air Ministry)	127	149	127	149
Totals ...	194,000	178,450	183,299	169,707

GENERAL REMARKS

In this centenary year it is very gratifying indeed to be able to report once again a record number of subject-entries for the various examinations conducted by the Society. With a grand total of 194,000 the record total of last year has been exceeded by 15,550.

For the first examination in 1856, 52 candidates from Mechanics Institutes in various parts of the country attended at the Society's House in London and worked 203 papers. Now, the examinations are held at about 900 centres in all parts of Great Britain and Ireland, and in various parts of the British Commonwealth under the control of local education authorities or of government-sponsored bodies. Examinations in English are also held at specially arranged centres in certain foreign countries under the control of an official of the British Embassy, or of the British Council.

ENTRIES

At the Ordinary (Single-Subject) examinations there were 10,551 additional entries, mainly in the subjects of Typewriting, Shorthand, English Language,

English for Foreigners, and Arithmetic. In Typewriting there were about 5,000 additional entries and these were spread over the three stages of the subject. In Shorthand, however, while there was an increase of about 2,000 entries these were in the lower speeds of from 50 to 100 words a minute: does this mean that under present conditions there is little incentive for shorthand writers to put in the necessary practice to reach the higher speeds of shorthand? In English Language there were nearly 3,000 additional entries, which demonstrates that this comparatively new examination is meeting a need. Its introduction may have affected the numbers of entries for the examinations in English (with literature), which decreased by about 500, but it is gratifying that, over-all, there is this increased popularity of the study of English, no matter which examination is taken.

The numbers of entries for the School and Senior School Commercial Certificate examinations, and for the Grouped Course examinations, have also shown a satisfactory increase. At the latter examination this increase was mainly for the Technical Grouped Course. And for the first time for several years there was a slight increase in the entries for the examinations in Road Transport Subjects, although the total is very small indeed when the number of potential candidates in the transport industry is considered.

In West Africa the entries for the Ordinary (Single-Subject) examinations increased from 4,113 to 6,157. These were spread over most of the subjects of examination. In addition, 688 candidates in Nigeria took the School and Senior School Commercial Certificate examinations, their individual subject-entries being 4,775 as against 5,729 in 1955.

In March, 1956, the Society once again organized the preliminary examination of candidates under the apprenticeship schemes of the British Transport Commission. As last year, the scheme was designed to help in the selection of traffic and accountancy apprentices of the British Railways and also of port apprentices of the Docks Division of the Commission. The three sets of candidates worked the same papers in English and Geography/General Knowledge, together with a special paper in their particular field of study, namely Railway Subjects—Commercial and Operating, Railway Accounts and Statistics, or Port Operation and Administration.

Further examinations have been conducted in connection with the scheme of endorsement by the Society of certificates awarded by the Royal Air Force to their Administrative Apprentices. Examinations in Arithmetic and English were held in November, 1955, and in March and July, 1956. In July, 1956, the scheme was extended to include examinations in Shorthand at eighty words a minute.

Special examinations in Shorthand and Typewriting for the award of proficiency pay to employees of British European Airways were held in October, 1955, and April, 1956.

TEACHER'S CERTIFICATE IN SHORTHAND

At the examination in November, 1955, there were 202 candidates, of whom 72 passed in all sections and three were 'referred' in the Speed Test only; in addition, 19 were granted exemption from Part I and five from Part II. This exemption is at the discretion of the Panel and is conditional on the candidate's completion of the examination within 12 months. In May, 1956, there were 392 candidates, of whom 112 passed in all sections, 11 were 'referred' in the Speed Test only, and 56 were granted exemption from Part I and eight from Part II.

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At the examination in November, 1955, there were 124 candidates, of whom 46 passed in all sections, 18 were granted exemption from Part I, and two from

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TEACHER'S CERTIFICATE IN TYPEWRITING

At the examination in November, 1955, there were 124 candidates, of whom 46 passed in all sections, 18 were granted exemption from Part I, and two from

Part II. In May, 1956, there were 282 candidates, of whom 108 passed in all sections, 31 were granted exemption from Part I, and 13 from Part II.

CENTENARY PRIZES

As announced in the introduction, to mark the occasion of the centenary of the first examination, the Council have approved the award of special Centenary Prizes to candidates submitting the best papers in certain subjects, or groups of subjects, at the combined Easter, Whitsun, and Summer Series of 1956. In addition to the cash prizes, the successful candidates will receive specially inscribed certificates. A list of the successful candidates will appear in the report which will be published later this year as a separate pamphlet.

NEGOTIATIONS WITH THE MINISTRY OF EDUCATION

In November, 1954, the Council submitted a resolution to the Ministry of Education on the subject of examinations for secondary schools, and in January 1955 a deputation of the Council was received by officials of the Ministry when the resolution was discussed in detail. The reply from the Ministry was incorporated in Circular 289. In March, 1956, the Society submitted to the Ministry their detailed comments on the points raised in Circular 289, and reiterated their recommendation that, at the discretion of the head teacher, pupils of secondary schools in their sixteenth year should be allowed to take appropriate examinations such as those conducted by the Society and by bodies of similar standing.

MEETINGS OF COMMITTEES

During the Session there have been, as usual, a large number of meetings of the various committees connected with the examinations, to the members of which the Society is deeply indebted for their help and advice.

Various changes recommended by the Advisory Committees have been approved. These include the introduction of (*a*) uniform hours for the three stages of examination, (*b*) new examinations in English Language, Stage III (Advanced), and in Shorthand at 150/160 words a minute, and (*c*) a Group Certificate in Secretarial Subjects. The syllabuses in the various subjects were reviewed, and minor changes were approved in those for the award of the Shorthand-Typists' Certificates.

SCHOOL TECHNICAL CERTIFICATE

The Society has approved the recommendation of the Examinations Committee that a scheme of examination for the award of a School Technical Certificate be introduced. This decision was reached after the insistent suggestion of such a scheme by many heads of secondary technical and secondary modern schools had been carefully considered by a specially appointed Advisory Committee. The scheme is similar in structure, standard, and general aim to that for the School Commercial Certificate, which was instituted in 1927. For many of the subjects the syllabuses and question papers will be the same for both schemes. The regulations require that candidates shall pass at one examination in at least five subjects selected from prescribed groups, and the general purpose of both examinations is the certification of a standard of attainment appropriate to boys and girls leaving secondary schools at the age of 16 years and taking up careers in the one case in commerce and in the other in some branch of engineering or building. The first examinations for the award of the School Technical Certificate will be held in June/July of 1957.

ASSOCIATE MEMBERSHIP

Six Silver Medallists at the Society's examinations in 1955 have been elected to Associate Membership of the Society.

GROUPED COURSE EXAMINATIONS, 1956, IN THE ADMINISTRATIVE COUNTY OF LONDON

COMMERCIAL AND GENERAL GROUPS—STAGE I

Subjects	Passed with Credit			Passed			Not Passed			Papers worked at Whitsun and Summer combined
	Whitsun	Summer	Total	Whitsun	Summer	Total	Whitsun	Summer	Total	
Arithmetic	3	—	3	7	6	13	23	24	47	63
Arithmetic & Accounts	—	5	5	2	14	16	6	22	28	49
Commerce	1	5	6	15	47	62	4	13	17	85
Economic Geography	1	—	1	3	—	3	36	11	47	51
English Language ...	7	42	49	51	127	178	6	91	97	324
French	—	—	—	2	3	5	24	12	36	41
History	—	—	—	3	1	4	8	4	12	16
Shorthand, 50 w.p.m.	—	9	9	1	20	21	2	99	101	131
,, 60 ,,	—	6	6	—	14	14	—	28	28	48
Typewriting	—	17	17	—	39	39	4	168	172	228
Totals	12	84	96	84	271	355	113	472	585	1,036

COMMERCIAL AND GENERAL GROUPS—STAGE II

Subjects	1st Class			2nd Class			Not Passed			Papers worked at Whitsun and Summer combined
	Whitsun	Summer	Total	Whitsun	Summer	Total	Whitsun	Summer	Total	
English Language ...	—	—	—	—	3	3	1	4	5	8
Shorthand, 80 w.p.m.	—	—	—	—	4	4	—	6	6	10
,, 100 ,,	—	—	—	—	—	—	—	1	1	1
Typewriting	—	1	1	—	9	9	—	21	21	31
Totals	—	1	1	—	16	16	1	32	33	50

TECHNICAL GROUP

Subjects	Passed with Credit			Passed			Not Passed			Papers worked at Whitsun and Summer combined
	Whitsun	Summer	Total	Whitsun	Summer	Total	Whitsun	Summer	Total	
English	31	89	120	171	551	722	16	217	233	1075
Mathematics	81	271	352	72	210	282	58	161	219	853
Science	56	170	226	46	164	210	24	90	114	550
Technical Drawing ...	53	117	170	73	318	391	41	291	332	893
Trade Calculations ...	8	18	26	4	67	71	15	153	168	265
Totals	229	665	894	366	1310	1676	154	912	1066	3,636

GROUPED COURSE EXAMINATIONS, 1956, AT CENTRES OUTSIDE THE COUNTY OF LONDON

COMMERCIAL AND GENERAL GROUPS—STAGE I

Subjects	Passed with Credit			Passed			Not Passed			Papers worked at Whitsun and Summer combined
	Whit-sun	Sum-mer	Total	Whit-sun	Sum-mer	Total	Whit-sun	Sum-mer	Total	
Arithmetic	7	2	9	4	13	17	23	19	42	68
Arithmetic & Accounts	3	3	6	8	7	15	11	54	65	86
Commerce	3	1	4	22	15	37	2	5	7	48
Economic Geography	—	—	—	1	3	4	15	21	36	40
English Language ...	15	54	69	42	88	130	18	42	60	259
French	—	—	—	1	4	5	10	10	20	25
History	—	—	—	7	1	8	15	12	27	35
Shorthand, 50 w.p.m.	3	15	18	2	13	15	19	66	85	118
„ 60 „	3	13	16	4	5	9	9	7	16	41
Typewriting ...	10	12	22	11	43	54	16	78	94	170
Totals	44	100	144	102	192	294	138	314	452	890

TECHNICAL GROUP

Subjects	Passed with Credit			Passed			Not Passed			Papers worked at Whitsun and Summer combined
	Whit-sun	Sum-mer	Total	Whit-sun	Sum-mer	Total	Whit-sun	Sum-mer	Total	
English	80	162	242	570	773	1343	173	457	630	2215
Mathematics	208	621	829	233	375	608	211	285	496	1933
Science	176	343	519	250	414	664	194	269	463	1646
Technical Drawing ...	90	141	231	328	504	832	267	479	746	1809
Trade Calculations ...	144	129	273	157	225	382	160	309	469	1124
Totals	698	1396	2094	1538	2291	3829	1005	1799	2804	8727

EXAMINATIONS IN ROAD TRANSPORT SUBJECTS, 1956

	Papers Worked	*1st Class*	*2nd Class*	*Not Passed*
1st Year—Road Transport Operation (Passenger)	216	64	125	27
" " " (Goods) ..	80	12	55	13
Communication and Report Writing ..	232	27	123	82
Road Transport Accounts and Statistics	205	24	98	83
2nd Year—Road Transport Operation (Passenger)	101	26	59	16
" " " (Goods) ..	26	1	22	3
Elements of Road Transport Engineering	49	6	23	20
Road Transport Accounts and Statistics	87	10	39	38
3rd Year—Road Transport Operation (Passenger)	74	13	49	12
" " " (Goods) ..	11	2	8	1
Road Transport Accounts and Statistics	36	1	13	22
Economics Applied to Road Transport	52	2	25	25
Totals	1,169	188	639	342

SCHOOL AND SENIOR SCHOOL COMMERCIAL CERTIFICATE EXAMINATIONS, 1956

School Commercial Certificate: Candidates, 1,806; Full Certificates Awarded, 605.
Senior School Commercial Certificate: Candidates, 472; Full Certificates Awarded, 94.

TABLE SHOWING THE NUMBER OF PAPERS WORKED IN THE SCHOOL AND SENIOR SCHOOL COMMERCIAL CERTIFICATE EXAMINATIONS IN 1956 TOGETHER WITH THE RESULTS

Subjects	*School Commercial Certificate Examination*				*Senior School Commercial Certificate Examination*			
	Number of Papers Worked	*Passed with Credit*	*Passed*	*Not Passed*	*Number of Papers Worked*	*Passed 1st Class*	*Passed 2nd Class*	*Not Passed*
English Language ...	1,794	137	974	683	484	12	141	331
Arithmetic	1,618	319	655	644	426	24	107	295
Accounts	1,197	155	400	642	444	47	121	276
Commerce	1,312	100	991	221	474	25	351	98
Shorthand : 50 w.p.m.	761	109	91	561	—	—	—	—
" 60 "	537	278	119	140	—	—	—	—
" *80 "	—	—	—	—	239	—	125	114
" *100 "	—	—	—	—	34	—	28	6
Typewriting	1,490	300	465	725	308	32	102	174
English Literature ...	1,162	26	464	672	277	3	83	191
Economic Geography ...	1,082	20	395	667	331	13	95	223
French†	256	39	151	66	28	4	15	9
History	437	16	160	261	54	7	16	31
History of the British Empire	304	8	90	206	214	12	67	135
Italian	1	1	—	—	—	—	—	—
Mathematics	281	49	79	153	86	9	27	50
Science	81	2	21	58	5	—	—	5
Spanish	46	4	22	20	36	4	9	23
Welsh	23	7	12	4	—	—	—	—
Totals ...	12,382	1,570	5,089	5,723	3,440	192	1,287	1,961

* In Shorthand at 80/100 w.p.m. there is one class of pass only.
† 15 Candidates took the oral test in French : 2 passed with credit and 6 passed

ORDINARY (SINGLE-SUBJECT) EXAMINATIONS

AUTUMN SERIES, 1955, AND EASTER, WHITSUN, AND SUMMER SERIES, 1956

Subject	Stage	Papers worked	1st Class (or Passed with Credit in Stage I)	2nd Class (or Passed in Stage I)	Not Passed	Total number of papers worked in each subject	
						1956	1955
Accounting	III	127	2	20	105	127	112
Advertising	III	27	2	14	11	27	30
Arithmetic	I	6,103	1,130	2,249	2,724		
"	II	1,030	122	304	604	7,305	6,649
"	III	172	12	55	105		
Book-keeping	I	6,581	1,275	2,686	2,620		
"	II	3,330	899	1,168	1,263	11,029	11,305
"	III	1,118	62	485	571		
Cargo Insurance	III	2	2	—	—	2	2
Central and Local Government	II	149	6	96	47	149	83
Commerce	I	1,672	145	762	765		
"	II	729	41	310	378		
" (Finance)	III	114	1	68	45	2,592	2,166
" (International Trade)	III	63	1	29	33		
" (Marketing)	III	14	—	1	13		
Commercial Law	II	157	19	71	67	203	254
" "	III	46	6	21	19		
Common Law	III	23	1	8	14	23	26
Company Law	II	22	3	11	8	49	68
" "	III	27	4	17	6		
Costing	II	91	7	33	51	124	143
"	III	33	—	21	12		
Danish	I	9	1	4	4		
"	II	6	—	4	2	17	25
"	III	2	—	1	1		
Dutch	I	—	—	—	—		
"	II	1	—	1	—	2	25
"	III	1	—	1	—		
Economic Geography	I	912	19	234	659		
" "	II	285	5	54	226	1,339	1,387
" "	III	142	1	21	120		
Economic & Social History	II	108	5	58	45		
" " "	III	108	2	50	56	216	212
Economics	II	479	65	272	142		
"	III	258	18	53	187	737	622
Elements of English Law	II	147	10	61	76	147	111
English (with Literature)	I	2,619	193	1,513	913		
" (" ")	II	1,022	53	495	474	4,322	5,278
" (" ")	III	681	43	368	270		
English for Foreigners	I	1,365	466	515	384		
" " "	II	1,482	190	822	470	3,145	2,231
" " "	III	298	37	153	108		
English Language	I	9,858	814	5,812	3,232		
" "	II	3,147	169	1,504	1,474	13,005	10,363
Esperanto	I	30	8	11	11		
"	II	26	9	5	12	73	34
"	III	17	1	10	6		
French	I	1,076	112	346	618		
"	II	340	31	84	225	1,617	1,716
"	III	201	15	75	111		
German	I	275	59	107	109		
"	II	142	39	52	51	446	421
"	III	29	5	13	11		

ORDINARY (SINGLE-SUBJECT) EXAMINATIONS

AUTUMN SERIES, 1955, AND EASTER, WHITSUN, AND SUMMER SERIES, 1956—*continued*

Subject	*Stage*	*Papers worked*	*1st Class (or Passed with Credit in Stage I)*	*2nd Class (or Passed in Stage I)*	*Not Passed*	*Total number of papers worked in each subject* 1956	1955
History	I	332	4	156	172	**332**	216
History of the British Empire	I	35	—	12	23		
" " "	II	56	3	26	27	**131**	111
" " "	III	40	1	17	22		
Income Tax Law & Practice	III	11	5	6	—	**11**	15
Italian	I	206	91	84	31		
"	II	72	31	30	11	**297**	307
"	III	19	8	9	2		
Law of Evidence and Civil Procedure	III	7	2	3	2	**7**	11
Law of Trusts	III	4	—	1	3	**4**	4
Norwegian	I	6	2	2	2		
"	II	4	1	3	—	**15**	8
"	III	5	—	4	1		
Public Administration ...	III	69	—	20	49	**69**	58
Real Property and Conveyancing	III	11	2	6	3	**11**	12
Russian	I	33	12	11	10		
"	II	17	5	3	9	**63**	66
"	III	13	4	4	5		
Secretarial Duties	II	200	26	122	52	**200**	—
Shipping Law and Practice	III	18	—	9	9	**18**	10
Spanish	I	345	93	116	139		
"	II	120	53	36	31	**517**	449
"	III	52	22	16	14		
Statistics	II	70	20	33	17	**95**	80
"	III	25	7	16	2		
Swedish	I	6	2	2	2		
"	II	6	—	3	3	**12**	6
"	III	—	—	—	—		
Typewriting	I	26,117	7,108	8,323	10,686		
"	II	16,383	1,139	5,119	10,125	**48,104**	43,458
"	III	5,604	421	1,938	3,245		
Welsh	I	19	3	16	—	**19**	14
		Papers worked	*Passed with Credit*	*Passed*	*Not Passed*		
Shorthand :							
50 words per minute		10,977	1,480	2,210	7,287		
60 " " "		9,071	2,550	2,642	3,879		
		Papers worked		*Passed*	*Not Passed*	**45,769**	44,056
80 words per minute		15,101		8,273	6,828		
100 " " " ...		6,282		2,108	4,174		
120 " " " ...		3,894		1,103	2,791		
140 " " ...		444		119	325		
Shorthand-Typist's Certificate							
Stage II		2,709		1,803	906	**3,023**	3,230
Stage III		314		165	149		
					Totals	**145,393**	135,374

PEAT IN CANADA AND BRITAIN—ECONOMIC IMPLICATIONS

A paper by

NORMAN W. RADFORTH, M.A., Ph.D.,

Professor of Botany, McMaster University, Ontario,

read to the Society on Tuesday, 3rd July, 1956, with Sir John Simonsen, D.Sc., LL.D., F.R.I.C., F.R.S., a Member of Council of the Society, in the Chair

THE CHAIRMAN: Since its formation this Society has always had very many overseas Fellows. Only this year we celebrated the bicentenary of one of our most famous Members from overseas, namely Benjamin Franklin, of whose work in London Professor Andrade gave such an inspiring account in his Trueman Wood Lecture.

During recent years our relationship to overseas Fellows has come even closer, due I think to the overseas visits paid by our Chairman, other members of Council and our indefatigable Secretary. In Canada now we have five honorary corresponding Members. It is therefore fitting that the final paper of this Session should be given by one of our Fellows from overseas. We therefore welcome very cordially our lecturer this evening who, although born in this country, has received, I think, most of his education in Canadian universities. Professor Radforth is now Professor of Botany at McMaster University; unfortunately my knowledge of botany is too limited to enable me to give you any account of his contributions to this subject, although I believe that his main interests lie in experimental morphology and palaeontology. This afternoon he is going to give us an account of a work which I think is very near his heart, namely peat. He is going to tell us something about peaty terrain and its influence as a factor in development over Great Britain and in Canada.

The following paper, which was illustrated with a film and lantern slides, was then read:

THE PAPER

It is not difficult to accept that Britain and Canada are bound together informally, if not formally, by commercial, political and racial ties. On the other hand, it is hard to persuade oneself from casual comparisons that the two countries possess significant physical features in common which are important enough to provide economic limitations at a national level. Yet there is at least one example, as more intensive examination reveals. Peat-land as it is often called in Britain; muskeg as it is known in Canada, is a physiographic medium in which common problems are found.

Peat-land creates a limitation on land use. Unless it can be rehabilitated it has little to reward human enterprise. It does not respond to normal farm management techniques, and presents a serious problem for the forester. It is inadequate and unproductive for livestock. High volume production, combined with mechanization, has established new economic horizons for the farmer exploiting mineral terrain. However, this situation ends at the edge of the

peat-lands. Here, communications practically break down, foundation engineering is almost overwhelmingly difficult, and it is not a practical proposition even to try to work the land while it is in its inherent conditions.

If peat-lands exist as overburden obstructing potential mining development, the normal economics of mining are completely changed. In well-drilling alone the Western Canada oil industry more than doubles its costs when operating on muskeg.[1] Sociologically, peat-lands are making an increasingly serious impact, especially in the face of future laws of survival. The pressure for food, fuel and commodities is forcing us to look again at peat-lands, and increasing populations verging on them are hopeful for action.

This multiple problem gathers significance when field operations are attempted. The reasons are numerous in Britain as well as in Canada. A controlling one is the inability to transport heavy equipment across the terrain. Wheel, and most track vehicles fail to negotiate large areas of peat-land. There are many known cases of vehicles sinking out of sight. In some types of peat-land subsidence is apt to occur so quickly that vehicle operators have little opportunity to free themselves before being submerged.

Avoidance of this and almost all other types of difficulties, primary or secondary, depends upon development of ability to predict terrain conditions in order that all kinds of projected development can be intelligently planned. However, this is not easy because muskeg or its British equivalent lack apparent signs of organization. Where no order reigns, no classification is possible. Without the aid of categorization, sound prediction is not possible. Therefore research is urgently required.

Research on peat-lands in the Commonwealth is now getting some well-deserved support. The McAuley Soil Science Research Institute of Aberdeen encourages a programme of fundamental and applied agricultural research. Instructive field experiments and technical procedures are to be seen in the Scottish lowlands at the field station of the Peat Section, Department of Agriculture, Scotland. Here, methods of peat-land reclamation are investigated after most of the peat coverage has been removed. The Director of the venture, Mr. A. Tomter, is making a marked contribution. The mined surface peat is processed for fuel for final transmutation to electrical energy in northern Scotland. The field demonstration of Dr. John Smith, former Director of Agriculture in the Sudan and now resident in Coalburn, is equally inspiring, more especially so because his programme provides exciting promise for the crofter. In fundamental research the work of Professor Godwin of Cambridge University has made a considerable contribution to knowledge. Liaison with Canada is maintained by Professor John Walton of Glasgow University. In that country we are glad to hear how solutions to peat-land problems are being met. Advice of the nature of that supplied by Messrs. Gardner, Hunt and Mitchell concerning the 'Muirfad' technique of peat-land improvement[2] is especially welcome.

Professor Walton is the only overseas member of the Muskeg Sub-committee of the Associate Committee on Soil and Snow Mechanics of the National Research

Council of Canada. This is one of four organizations supporting work on muskeg across the sea. The Council is actively engaged in research at the laboratories of the Division of Building Research. Other centres are the Department of Civil Engineering, University of Alberta in Edmonton, The Muskeg Laboratory of the Imperial Oil Co. in Calgary Alta, and the Muskeg Laboratory, Department of Biology, McMaster University, Hamilton, Ontario. A fifth organization, though not participating directly in research, supports the work of the author. This is the Defense Research Board, Ottawa.

In Canada there are well over 500,000 square miles of muskeg. Though this is an enormous area, it is no more significant proportionately than the organic mantle covering much of Britain. In the latter case, the obviously greater population pressure offsets the apparent advantage of comparatively small average. The possibility of conquering these vast peat-lands has involved the launching of many projects. In every case for the investigator, disappointment has arisen owing to the apparent disorganization the terrain showed. Consequently this problem has provided the primary objective for peat research. Superficial examination of muskeg was encouraging the belief that organization would never be revealed in peat-land, until finally the suggestion was offered through the results of palæobotanical endeavour.[3, 4, 5]

It has been known for some time that successive intervals of accumulated peat can be identified in relation to their time of formation. To do this, botanists drew from the legacy of tree pollens of past ages. These minute bodies, alike only for a given species, settled from the air and became fossilized in the vegetal *débris* of other plant parts that together formed the peat banks. From investigations of these tree pollens, the forest history and the record of past climatic change are gradually being revealed. This provided indirectly the first contribution towards solving the problem of peat organization, but it was hoped that help could be of a more direct and less general nature. In the far north of Canada the number of tree species was limited to only three or four that showed promise of significant help, and even these did not aid in distinguishing peat which displayed structural differences on a macrostructural basis, but which were removed from the same area.

The reader may well question why the local problems could not be solved by reference to macro-contrast. This was actually attempted, but the results were of limited or uncertain value. In the first place, chemical change, observable by inspection of colour relations in the peat, differed in rate and in location. The pattern of difference did not seem to coincide too well with the pattern suggested by mechanical change. Thus, macroscopic variation could not be judged entirely on a biological basis. Also, when macro-structure differentiation was attempted for classification purposes it was too difficult to predict how far laterally the type would extend, especially if the types of macro-units were mixed. This made prediction of terrain character from given samples an uncertain proposition. Finally, even when specific macro-unit types predominated in given samples—not a frequent circumstance—the observer tended to be subjective because large units would be favoured, and the significance of small units would be

underestimated in importance in the process of predicting terrain properties. Because of these several difficulties it was concluded that true index value, as revealed by macrofossils and involving arbitration, could be evaluated only after justification from microfossil evidence derived from considerations of natural circumstances.

Even with microfossils it was not until attention, and some emphasis, were given to pollens and spores contributed by plants from *in situ* that local difference could be accounted for. Pollen from trees might have come from afar, and have contributed insignificantly to the local circumstances governing peat structure. Whereas pollen and spores from non-tree types symbolized with greater certainty the plants which produced them in the immediate environment. The local ones would therefore indirectly index the nature of the structural properties of the organic mat corresponding to the location of the peat sample. To test this proposal large numbers of peat samples were investigated from randomly selected locations over a reasonably wide area (some 600 square miles) in the vicinity of Fort Churchill, Manitoba, immediately south of the southern shore of Hudson Bay (about the same latitude as the Orkney Islands).

Peats vary in depth. There may be only one or two inches of dead organic matter, but on the other hand fifty- to one hundred-foot examples are reported north-west of Edmonton in western Canada. Whatever the depth, the microfossil history, as analyzed inch by inch, accounts for structural composition level by level. Because the microfossils are as unquestionably identifiable as the parent plants giving rise to them, it seems reasonable to claim that macro-structure thus labelled is identified with the least possible artificiality.

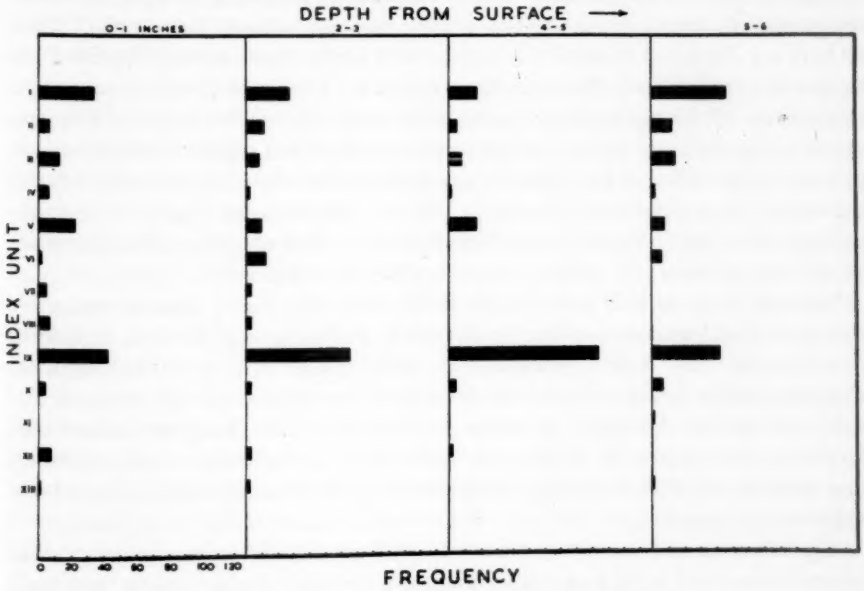

FIGURE 1. *Histogram pattern showing fixed type of sequence in microfossil history*

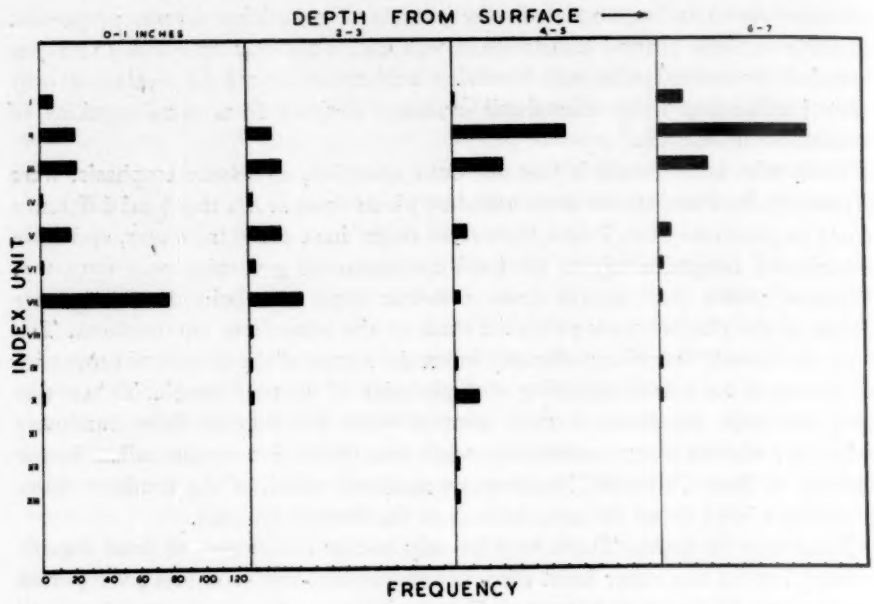

FIGURE 2. *Histogram pattern showing shifting type of sequence in microfossil history*

Characterization by microfossils is portrayed by histogram bars. A single bar represents the frequency at a given level of one microfossil (index unit). When all bars are displayed in parallel sequence for a given depth, and all depths of the sample are represented, the diagram so derived is known as a histogram pattern (Figure 1). All histogram patterns differ in some degree, but major differences are of a characteristic nature. Differentiation is such that categories of histogram patterns arise. Also, if the patterns are examined in detail, some show relative constancy of composition (Figure 1), others constitutional change (frequency changes with depth, Figure 2). Still others reflect a kind of biological indifference. Whatever the trend, the pattern can be explained ecologically.

Though there is still much work to be done the claim is now reasonable that peat-land organization can be revealed, and categories of peat identified. Microfossils, the index components that made this possible, facilitate characterization in other ways. In the laboratory where they are isolated and counted[3] derived histogram patterns are correlated with macrostructure.[6] The latter can be designated in terms of granularity and fibrosity, non-woodiness and woodiness. Also prediction of the extent and eventual modification of the type can be proposed.

Though this means of classification and prediction is encouraging, field identification and terrain analysis remained a problem. Inspection of peat lands in the field when no laboratory advice was at hand was still accompanied by

bewilderment, and even if analytical data were available conversion to field reference was a difficult matter; certainly a job for experts. Hopes therefore turned to the possibility of correlating subsurface characteristics with surface. To do this, reference entities had to be established as indicators of vegetal difference because the conspicuous markers were the modern plants constituting the living organic layer covering the peat.

At first it was thought that the vegetal cover could be readily assessed by reference to associations of plant species. There were two major objections to this: utilization of species as reference entities created difficulty for the engineer and for others who were not trained in plant systematics; in the Canadian north, south to latitudes well beyond the so-called tree line, given species showed annoying indifference to what might be their association limits. To approach the first objection, attempts were made to discover whether independent and botanically untrained observers working in the same area could relocate each others' field station using as guide some function of vegetal character without referring to plant names. In reference procedure it was found that observers made use of such entities as plant stature and structural composition, woodiness, presence or absence of leaves and leaf form, and so forth. Occasionally, relative predominance of these features was noted, and reasonable agreement was encountered among observers involved.

To bring the method into practical and extensive use it was refined for further testing. Statute categories were assigned. Differentiation was not established entirely on an arbitrary basis, because it was discovered that there were stature categories that were not so numerous as to confuse. Other structural entities were combined with stature to provide a classification system for surface vegetation. This was scrutinized and adjusted appropriately to establish validity on the basis of botanical principles.

Details of this system have been described elsewhere.[3] The fundamentals of the method require only nine classes of vegetation. These are shown in the table of descriptions, Table I. In combination they are said to constitute formulæ. Fortunately, the number of actual combinations is much smaller than the number that is mathematically possible. There are fewer than 25 that are common.[7] Each formula shows the predominating class on its left as designated by the appropriate letter symbol. Other classes follow, but a total of no more than three classes constitutes coverage designation. Any element that may be present in the field in an amount less than 25 per cent of area covered is regarded as negligible.

The next step in correlation of surface with subsurface was to demonstrate relationship between the appropriate systems of reference. When this was achieved the field observer, by determining cover formulæ, could predict subsurface conditions, sometimes over areas of considerable extent as time and circumstances would direct. Further study revealed that certain topographic factors characterizing the terrain bore discernable relationship to cover types. Examples categorized as to cover by formula FI showed a high incidence of interruption by shallow lakes, ponds or high water table. An example of this

TABLE I. VEGETAL COVER CLASS DESIGNATIONS AND THEIR MEANINGS.

(Reprinted, after Radforth.)

Coverage type (Class)	*Woodiness vs. non-woodiness*	*Stature (approx. height)*	*Texture (where required)*	*Growth habit*	*Example*
A	Woody	15 ft. or over	—	Tree form	Spruce Larch
B	Woody	5 to 15 ft.	—	Young or dwarfed tree or bush	Spruce Larch Willow Birch
C	Non-woody	2 to 5 ft.	—	Tall grass-like	Grasses
D	Woody	2 to 5 ft.	—	Tall shrub or very dwarfed tree	Willow Birch Labrador tea
E	Woody	0 to 2 ft.	—	Low shrub	Blueberry Laurel
F	Non-woody	0 to 2 ft.	—	Mats, clumps or patches, sometimes touching	Sedges Grasses
G	Non-woody	0 to 2 ft.	—	Singly or loose association	Orchid Pitcher plant
H	Non-woody	0 to 4 in.	Leathery to crisp	Mostly continuous mats	Lichens
I	Non-woody	0 to 4 in.	Soft or velvety	Often continuous mats, sometimes in hummocks	Mosses

is shown in Figure 3, in a photograph showing the FI condition in a Scottish peat bog near Biggar, Lanarkshire. Beneath HE coverage old beach ridges were common. Some other types signified hummocking, others hidden boulders. Terrain irregularities of various types could be linked with vegetation character. The chief physiographical features and cover types with which they are found are listed elsewhere.[6]

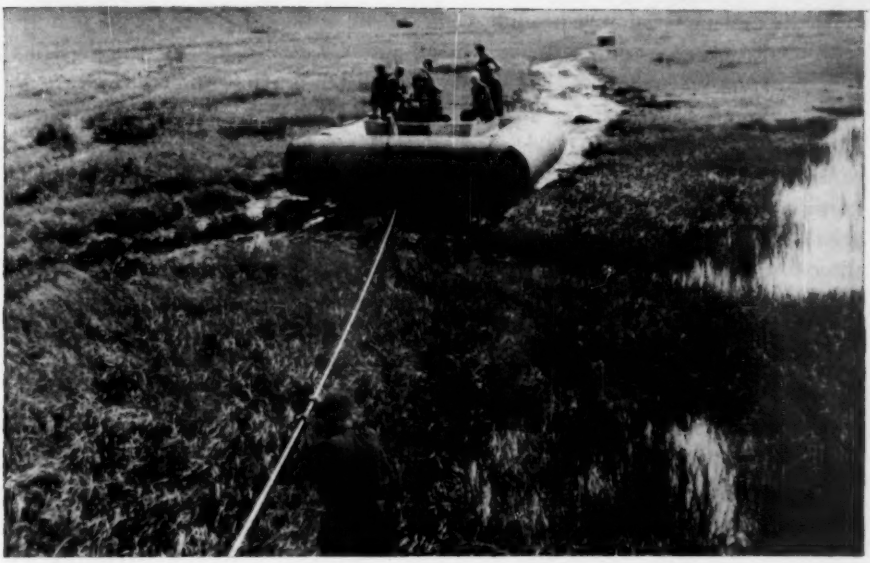

FIGURE 3. *A modified version of the 'Water Buffalo' travelling by winch in FI peatland with open ponding*

In northern Canada an unusual set of physiographical features arises because of the continental climate and presence of permafrost. Every spring the top of the frozen mass hidden within the peat slowly descends. The insulating effect of the peat ensures that the process of thawing is a slow one. It also obtains that the surface contour of the ice differs as to the pattern, depending in part at least upon the nature of the peat enclosing it. Thus, ice-surface contour hidden beneath the surface, and which is important in assessing terrain, can be suggested by indirect reference to surface cover. This completes the task of relating surface to subsurface and affords the last step facilitating interpretation of subsurface character.

In spite of progress not all the difficulties are solved yet. Earlier it was emphasized that access over certain types of peat-lands is well-nigh impossible. Thus classification, much less utilization, is still difficult to achieve. This is why techniques of aerial survey have been devised and applied. For these matters, a separate study developed with the ground level investigation.

The first aerial photography recording intimate details of muskeg was achieved with the assistance of the Royal Canadian Air Force. With a special camera housed in the belly of a 'plane, and synchronized as to shutter speed with the speed of the 'plane, continuous strip photographs were taken in Kodacolour at altitudes not exceeding 300 feet. These were later supplemented by air-photographs of the same terrain from several altitudes up to 17,000 feet. The operations were repeated at different times of the summer and the colour records were augmented by photographs in black and white. Finally, from a different source air-photograph records taken at 30,000 feet became available.

All of this material was brought into use by comparing vegetation patterns experienced on the ground with 'air form' patterns seen in the air-photographs. It will be appreciated that air-ground comparisons in the initial phases of the work required much study, and much checking had to be done before an interpretive method could be devised in reliable fashion. Low altitude air-form patterns seen as configurations on the photographs had to be explained in terms of either single, or more often groups of, cover formulæ. Once this had been achieved for standard conditions, the procedure was extended to include all conditions encountered to 1,000-foot altitudes. The interpretive method was then constructed on the basis of a number of cases where ground condition could be checked. The results and methods are now printed in handbook form.[5]

The final stage in the aerial work has yet to be completed. However, some results may be offered here. It has been found necessary to delineate for investigation five major types of 30,000-foot air-form pattern. These are distinctive, and have been named Dermatoid, Stipploid, Terrazzoid, Marbloid and Reticuloid. Each pattern has necessitated its own research investigation. The results were in part expressed in a recent paper presented at the Annual Meeting of the Canadian Institute of Mining and Metallurgy (Petroleum Division). Here reference was made to the fact that the first interpretive data alluding to subsurface conditions, and derived from 30,000-foot inspection, had been procured.[11] It may now be reported that data of this nature are at present being put to practical purpose in northern Canada. It has been possible to advise on route direction for summer access requirements north of The Pas, Manitoba, in an area where transportation of heavy loads is needed for distances up to one hundred miles. Qualitative information is also suggested on relative peat depth, bearing capacity, subsurface ice character and drainability for every quarter mile of route selected.

However, because of the low shear strength of peat mats, and low bearing response to heavy loads, selected routes have a high frequency of deviation. Thus, in many cases route length is as much as one-third longer than the shortest distance connecting the extremities of the routes. When journeys are longer than ten miles, this factor becomes considerable, and may seriously limit operations or cause them to be discarded.

For this reason particularly, many engineers in Canada are greatly concerned, and it is quite understandable. Attempts are being made to derive engineering tests to parallel those made on mineral soils. Techniques of road construction are under consideration.[8,9,10] Vehicle performance and manœuverability are subjects of interest and study wherever muskeg is involved. All available information is being co-ordinated into a bibliography of muskeg and peat-land research.[11]

In the matter of vehicle development Britain, in the opinion of the author, is well ahead. The first vehicle to get bogged down in peat-land and pull itself out effectively was designed by James Cuthberton, O.B.E., of Biggar, Scotland. Known as the 'Water Buffalo', this vehicle, operating on tracks, is capable of quite remarkable performance in peats of fairly low shear strength. In that it is

buoyant in saturated peat it is never likely to submerge. When tractive effort fails it winches its way out of the predicament on an anchored wire cable. Under these circumstances it can haul several tons, or do the equivalent in other types of work, for example, ditching or laying conduit.

A modified version of the Water Buffalo, also designed under Mr. Cuthberton's direction, has recently been produced, and sent off for operations in Canada following successful trials in Lanarkshire. One of the most significant features about it is its complete buoyancy in open fresh water. That it can proceed over the worst category of peat-land notwithstanding its ten tons and a five-ton haul load is nothing short of remarkable. Like its prototype it depends upon a cable when all tractive effort fails. The cable loops over a capstan-type winch which operates at a speed equivalent to that of the tracks. The anchor for the cable is easily secured by half-inch steel tubes which are inserted into the terrain through holes in the anchor plate. Pressure applied by pushing with the palm of the hand on the free end of the tubes is ample for driving them into the soft peat. If more than one passage of the vehicle is required the right-of-way subsequently floods, and the Water Buffalo depends largely upon its buoyancy potential. Complete buoyancy is achieved by the large tanks applied on all sides of the hull.

An extension of the principles employed in the Water Buffalo has been suggested[12] in what is known as the Slipe Haul System. For this, the hull of the vehicle is somewhat barge-shaped. Four aeroplane-type wheels are built into the hull for buoyancy when traversing intermittent mineral terrain or relatively hard peat-land. Power generated in the machine is applied to a capstan-type winch operating on a three-quarter-inch steel cable. Because the wheels are unpowered, the machine when in operation depends entirely upon the cable which is laid down over the predetermined route prescribed according to the procedure suggested earlier. These powered Slipes now under development at Biggar are much cheaper than Water Buffaloes, thus allowing for greater load-carrying potential with less expenditure. Chance for mechanical failure is lessened and the vehicles, several to a cable, can travel the shortest possible route over the most difficult terrain without embarrassment.

It would now seem that the way is clear for a stepped-up programme of peat-land exploitation in both Britain and Canada. With access difficulties largely obviated, construction and utilization can be encouraged. It is hoped that muskeg classification and interpretive procedure now possible will give direction on matters of drainage should this be desirable for agricultural and forestry purposes. Removal of peaty overburden for strip-mining can be achieved with happier results economically with the application of interpretive measures. Better and more lasting roads can be built with the improved chances of good planning. For the same reasons it is hoped that procurement of properly processed peat for consumption in electric power production will be facilitated. Certainly in this and other respects we can hope for better management of peat resources—a conservation measure necessary in wise national economy.

It seems appropriate to mention here that peat-land study as suggested in this

account is known in Canada as Palæovegetography. The author readily agrees that the expression is somewhat unpalatable But it does not suggest—and this is worth emphasizing—that muskeg or peat-land is merely peat. For convenience, if for nothing else, it is surely wise to agree that these entities define ordered accumulations of fossilized plant-remains existing in association with specified mineral-soil sublayers. The distinctive living vegetation covering the peat, and the attendant physiographical phenomena, are no less a part of the complex. The whole is now becoming known as organic terrain.

ACKNOWLEDGMENTS

The author is indebted to the Associate Committee on Soil and Snow Mechanics, National Research Council, Ottawa, and to the Defence Research Board (Geophysics) of Canada for financial aid supporting the Canadian aspects of these investigations.

DISCUSSION

THE CHAIRMAN: I am sure we are all extremely grateful for this very interesting paper. Peat is principally utilized as a source of fuel: many Scots people say there is no fire in a room which is so delightful as a peat fire. More recently, of course, as seen in Ireland and in Scotland, came the attempt to use those great peat deposits as a source of energy to which Professor Radforth has already referred. I think from his paper to-day we see much greater possibilities underlying those well-known peat deposits.

I would like to ask Professor Radforth on my own behalf how far do those deposits, of which he is examining the microfossils, give any insight into the former vegetation which has been studied in the past, I believe, by pollen work especially in Scandinavia. I wonder if these two lines of work are correlated at all?

THE LECTURER: I think I can give some sort of encouraging answer. The microfossils to which I have been referring are, in fact, I am sorry I did not make this clear, pollens and spores. They are, however, not mainly pollens and spores of trees, they are pollens and spores of plants that have contributed them from *in situ* positions, that is with direct reference to the area in mind. Pine pollens have been found over Greenland having been blown there from the Labrador coast. We also find pine pollens in the Churchill area and yet there are no pine trees for sixty to seventy miles away and therefore it is somewhat dangerous to refer to these pollens, if we are thinking of tree pollens, unless we can estimate what their relative importance is with respect to the site which we have in mind. However, if we refer to pollens and spores of plants grown *in situ* for the history of the peat, then we can get a better idea of the construction and really make valid use of these pollens.

THE CHAIRMAN: I do not think we could have had a better paper to introduce us to this very interesting topic, which is perhaps completely new to us, than that which has been given to us by Professor Radforth. I marvel at the way in which he could speak without a note to his slides or the film, and make everything so wonderfully clear to us, whether he was dealing with the wilds of Canada, the northern part of Great Britain, or the plague of mosquitos and black fly to which he made just adequate reference. I know from what I have heard from Professor Buxton who worked in that part of the country that it is a real menace. I would therefore like on your behalf to thank Professor Radforth for his very brilliant paper.

A vote of thanks to the Lecturer was carried with acclamation, and the meeting then ended.

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EXTINGUISHING FIRES IN OIL-STORAGE TANKS

THE USE OF THE COX SUBMARINE BOLT-DRIVING GUN IN RELATION TO THE BASE INJECTION OF AIR INTO OIL-STORAGE TANKS FOR CONTROLLING AND EXTINGUISHING FIRE

As was announced in the *Journal* for 12th October, 1956, the winning entry for the Fothergill Prize for fire prevention or fire fighting was that submitted by Mr. S. Harrison, A.M.Inst. Pet., A.F.I.C.D., Chief Fire Officer of the Kuwait Oil Co., Ltd. A condensed version of his entry is given below:

The author's suggestion is based on two factors:

(*a*) The Cox submarine bolt-driving gun (manufactured by Messrs. Siebe Gorman, Ltd., United Kingdom), and

(*b*) The principle of base injection of air for extinguishment or control of oil fires.

It is the combined use of (*a*) with (*b*) that is original.

(*a*) *The Cox submarine gun* gained prominence during the last war when its valuable use for injecting air through the side of a submerged submarine (unable to surface) saved many lives. The gun fires a special hollow bolt with detachable piercing head through steel plate. By a unique arrangement an air pipe can be connected to the exterior portion of the bolt and the piercing head may be removed without leakage from or into the object pierced. Steel plate to a thickness of one inch can be penetrated by this method, which therefore brings within scope the base strake plates of oil-storage tanks.

(*b*) *The principle of base injection of air for extinguishment and control of oil fires* is one which gained original thought in England, but which has since been developed to a high standard of efficiency in the United States (mainly under the prompting of Mr. J. L. Risinger, Socony-Vacuum Oil Co., Inc.). The principle is simply that of using air as an agitating agent to bring cool oil from below a burning surface to mix with and replace the heated surface oil, thus to extinguish or control a fire by starving the vapours which feed the hydro-carbons and which in turn sustain ignition.

With this system, oil with a flash point above its stored temperature may be totally extinguished, and in the case of an oil with a flash point below its stored temperature the fire may be well controlled and extinguished with minor hand equipment.

A normal base air injection installation, however, entails the use of tank interior and exterior pipework, the exterior piping leading through the bund walls to a conveniently sited compressor unit (fixed or mobile), and interior piping welded to convenient supports into the centre or around the tank inner walls.

Tankage already containing oil could not therefore be readily adapted, as first the tank would have to be emptied, and secondly cleaned out and steamed, which process in a large tankage area would be grossly uneconomical and oftimes impossible due to heavy storage commitments. The problem, therefore, was to arrive at some system which could supply air into the base of a tank in regulated quantity in the event of fire, which would not cause an escape of tank contents and would be safe and effective in operation. The writer eventually formulated the idea of utilizing the Cox submarine gun.

The optimum air rate required for a tank of 100 feet in diameter necessitates one compressor unit only, capable of 750 cu. feet free air per minute. The Cox submarine gun could pass this amount through four piercing bolts. Therefore, with a four-way air take-off manifold fitted to the compressor unit, one unit would suffice. The suggestion outlined could well revolutionize existing methods of oil tank protection, any of which are susceptible to damage due to explosion in the early stages of a fire. Fixed foam installations are costly and frequently ineffective under actual fire conditions.

The Cox submarine bolt-driving gun costs under £100, and even should it be necessary to purchase a mobile or fixed compressor unit, the over-all cost would only represent a fraction of that for the more orthodox foam installations, and so on.

The writer has received full encouragement in carrying out base air experiments under actual fire conditions from his Company. Resulting from the success of these experiments, base air installations are now regarded as standard on all new tankage constructed for the Company, which is one of the principal oil companies in the Middle East.

HOWARD PRIZE ESSAY

As was also announced in the *Journal* for 12th October, 1956, this year's Howard Prize for mechanical motive power has been awarded to Mr. A. Enticknap for his essay on 'Gas Turbines and their application to road transport'. It is not, however, intended to publish this in the *Journal* as it has already appeared in print in the *Journal and Proceedings of the Institute of Road Transport Engineers*, vol. 9, part 2, November, 1955, p. 41, *et seq.* Copies of that *Journal* are obtainable from The Secretary, Institute of Road Transport Engineers, 69 Victoria Street, S.W.1, at 5*s.* each.

GENERAL NOTES

ARTS COUNCIL REPORT

The Arts Council is ten years old this year and its *Annual Report* for 1955/56, published in October, surveys the activities and policies pursued during that period in ensuring that the arts should be available to their growing public.

The *Report* removes a common misunderstanding by emphasizing that the Council's annual grant from Parliament, which in 1955/56 was £820,000, compared with £235,000 in 1946, is divided in advance among the various bodies to which the Council gives its support. For example £270,000 per annum is at present earmarked for the Royal Opera House, Covent Garden, the establishment of which, since 1946, as a permanent home for opera and ballet is the Council's achievement. A reduction in this or any other grant would not mean that more would be available for other branches of the arts.

In addition to its other work, the Council is at present preparing, at the invitation of the Chancellor of the Exchequer, a list of proposals for a building and reconditioning programme to provide theatres, concert halls and art galleries at centres where their provision may be expected to consolidate public interest in the arts—a need which the Council feels to be great.

The eleventh *Annual Report of the Arts Council*, entitled 'The First Ten Years', may be obtained from the Council at 4, St. James's Square, London, S.W.1, or from H.M. Stationery Office, price 2*s.* 6*d.*

DESIGN CENTRE

The Design Centre for British Industries, in the Haymarket, has now been open for six months. In that time, some 380,000 people have visited the centre, among them many trade buyers from overseas. The reports from exhibitors indicate that the displays at the centre have done much to stimulate public interest in good design. The centre has, in fact, provided that meeting ground for retailers, manufacturers, and the general public which was envisaged, and has amply repaid the great amount of work put into its establishment by the Council of Industrial Design.

That preliminary work, involving spreading the idea of the Design Centre by all means other than paid advertising, is described in the eleventh *Annual Report of the Council of Industrial Design* which, published last month, deals with the period 1st April, 1955 to 31st March, 1956. All aspects of the Council's work are covered in the *Report*, which can be obtained from the C.o.I.D., 28, Haymarket, London, S.W.1, or the C.o.I.D., Scottish Committee, 46, West George Street, Glasgow, C.2, price 1*s.* 6*d.* (1*s.* 10*d.* post free).

CONFERENCE ON AFRICA

A one-day Conference is to be held by the Royal African Society in the Lecture Hall of the Royal Society of Arts on Saturday, 17th November, 1956. The Conference will include talks on 'The Gold Coast', 'The Development of Africa', and 'The

Union of South Africa', and a film will be shown. Admission is free and is open to Fellows of the Royal Society of Arts and others interested in Africa. Full particulars are obtainable from the Secretary, The Royal African Society, 18, Northumberland Avenue, London, W.C.2.

RESEARCH AWARDS

Applications are invited for Leverhulme Research Awards for Fellowships or Grants in aid of research. The awards are intended for senior workers and are limited to British-born subjects normally resident in the United Kingdom. Although no restrictions are placed on the subjects of the enquiry, preference will be given to those in which existing provision for research is inadequate. The duration of the awards varies from three months to two years, depending on the nature of the work and the applicants' circumstances. The closing date for applications is 31st December, 1956. Full particulars and application forms are obtainable from: The Secretary, Leverhulme Research Awards, St. Bridget's House, Bridewell Place, London, E.C.4.

MODERN PORTUGUESE ARCHITECTURE EXHIBITION

An exhibition of illustrations of the most important buildings erected in Portugal in recent years is at present on view at the Building Centre, Store Street, London, W.C.1, where it will remain until 30th November. The exhibition is open from 9.30 a.m. to 5 p.m. on weekdays and from 9.30 a.m. to 1 p.m. on Saturdays. Admission is free.

OBITUARY

PROFESSOR SIR FRANCIS SIMON

We record with regret the death, at Oxford on 31st October, of Professor Sir Francis Simon, Dr. Lee's Professor of Experimental Philosophy, at the age of 63.

Francis Eugene Simon, C.B.E., M.A., Ph.D., F.R.S., was born in Berlin, and educated at the Universities of Göttingen, Munich and Berlin. In 1924 he joined the teaching staff at Berlin as *Privat-Dozent*, and three years after became Professor Extraordinary of Physics. He moved in 1931 to Breslau University, where he was Director of the Laboratory of Physical Chemistry. Two years later, with the rise of Nazism, he left Germany and joined the research staff of the Clarendon Laboratory at Oxford. He was connected with the atomic energy project from the beginning, and in 1945 became Professor of Thermodynamics at Oxford.

Under his leadership the low temperature physics group at the Clarendon Laboratory grew to be one of the foremost in the world. His interests in this field were wide, but he will be particularly remembered for his work on the third law of thermodynamics, which, owing mainly to him, is now recognized as one of the guiding principles of low-temperature physics. He had held his latest Chair, in which he succeeded Lord Cherwell, for only a month, but he was also widely known outside Oxford for his interest in technology and its teaching, and as an expert on fuel efficiency and coal conservation. He was knighted in 1954, having been appointed C.B.E. in 1946, and among his other honours was the Rumford medal of the Royal Society; he was a Foreign Honorary Member of the American Academy of Arts and Sciences. His publications included *The neglect of science*, and *Waste, the threat to our natural resources*.

Sir Francis was elected a Fellow of the Society in 1947.

MR. H. N. RIDLEY

We also record with regret the death, at Kew on 24th October, of Mr. H. N. Ridley, possibly the oldest of the Society's Fellows, at the age of 100.

Henry Nicholas Ridley, C.M.G., M.A., F.R.S., was educated at Haileybury and

Oxford. His first appointment was to the British Museum, where he worked in the Botanical department at the time of the transfer to South Kensington. In 1888 he was appointed director of the botanical gardens in the Straits Settlements, and in his 23 years there was foremost in the successful inception of the Malayan rubber plantations from the plants of *Hevea brasiliense* sent out from Kew Gardens. In 1911 he retired, and was appointed C.M.G. He took up residence at Kew, and from then on, until late in his life, he worked at the Herbarium there.

Mr. Ridley was a corresponding member of scientific societies at home and abroad, and was editor of the *Agricultural Bulletin* of the Straits Settlements and Federated Malay States, and Secretary and editor of the *Journal* of the Royal Asiatic Society, Straits branch, from 1889 to 1911. He was elected a Fellow of the Royal Society in 1907. In 1914 he received the gold medal of the Rubber Planters Association, while in 1928 he was awarded the American Frank Meyer Medal for foreign plant introduction. He was a member of the Linnean Society, on whose council he served, and whose Linnean medal he was awarded in 1950. Among his numerous publications, mainly relating to the Malay Peninsula, are *Flora of the Malay Penninsula* and *Dispersal of plants throughout the world.*

He was elected a Fellow of the Royal Society of Arts in 1899.

NOTES ON BOOKS

MODERN PUBLICITY, 1956–57. *Edited by Frank A. Mercer. Studio,* 1956. 42*s*

This is the twenty-sixth year of publication of *Art and Industry's* annual of international advertising art. Its date, 1956–57, it may be remarked, although it is the usual style for such publications, is a little misleading, since the advertising it contains was all produced during 1955.

The exterior of the book immediately introduces the international theme, since the jacket is by Hiroshi Ohchi of Japan, using black and one colour in pleasantly whimsical vein. The editor has as usual spared no effort to make the selection truly international, and in this he has been aided by correspondents who have sent in specimens from twenty different countries, ranging from Australia to Uruguay. The resulting volume of specimens, together with those sent independently from this country and abroad, is such that, as can well be imagined, 'Each year the task of producing this work becomes physically and mentally more arduous'. In this connection one is immediately led to wonder, ungrateful though it may seem, how far a selection made from material submitted, which is of course, on the whole, the only practicable way of securing specimens, can be representative. The answer is, fortunately, that advertising is the last profession to be inhibited about sending in material, and anyone scanning these pages can be sure that he is seeing that indefinable abstract usually defined by the concrete image 'cross-section'. Nevertheless, it would be interesting to know whether Mr. Mercer has restricted himself entirely to submitted material.

Examining this cross-section one is struck, as Mr. Mercer has been, with the fact that 'many advertisements could have been produced in any one of a dozen countries'. That this is the case is certainly in part a tribute to the wide distribution of such works as *Modern Publicity* itself, although in some ways it is to be hoped that as the countries now fashioning their means of mass communication come to maturity they may find something of a national style for themselves.

Some national characteristics are discernible, however, says Mr. Mercer, such as British whimsy. This one may well feel to be overdone at times, and from photo-montage giraffes in semi-stiff collars holding forth at board-meetings one willingly turns to the simple virile drawings of, say, Savignac, often expressing an idea without

a line of copy. In sharp contrast to such succinctness is a trend visible in some 'prestige' advertising, where copy-writers seem to be taking part in a private competition as to who, by sheer virtuosity in the exercise of his art, can link the most outlandish objects, such as sequins and soap, or cheese and catherine-wheels, an approach at its worst worthy only of a nation of tabloid and digest readers.

As an annual of advertising *Modern Publicity* must invite comparison with *Graphis Annual*, the Anglo-Swiss publication. *Modern Publicity* is the less expensive of the two by £1 13*s*., and probably contains more specimens, but the average size of the specimens is in consequence smaller. The typography and production of the Swiss-printed book is perhaps the more stimulating. But the work of the editor, and the publishers, of *Modern Publicity*, cannot be too highly praised in giving us year by year this selection of work, much of which would never otherwise come to one's notice, and without which the visual imagination of practising advertising men throughout the world would be the poorer.

MICHAEL OLIVER

OLD LONDON CHURCHES. *By Elizabeth and Wayland Young. Faber*, 1956. 63*s*

Let it be said at once that this book is full of interest to all and sundry and is of considerable distinction. It should certainly help to convince Londoners and others, who have not the knowledge and insight of the authors, that London's churches before 1830 possess a wealth of historical and architectural interest offering rewarding study.

The book has a special interest to-day when the policy of the London Diocese, whereby the City churches are now protected by law under the Guild Churches Act, is questioned by some people.

In their book, the authors, with a gallantry which is refreshing, have set out to write a brief historical sketch of something like 370 London churches, chapels and synagogues and they have achieved it almost without a dull word; indeed, their lively and often unconventional descriptions are both illuminating and entertaining, and very readable.

The text is divided into the following parts: first a Foreword—which should not be skipped if only for the piquant remarks on 'Books and Publications'. Secondly, the authors provide an 'Introduction' to the subject which covers briefly the period under review from earliest times up to 1830, including most, if not all, of the churches destroyed in the Second World War. It should be mentioned that in this Introduction the authors call attention to the sacramental purposes for which churches are built and the fundamentals relating to the design and planning of churches, a matter which sometimes goes unheeded to-day. Welcome, too, is their statement that 'a church is a setting for a living liturgy', a wise directive to church architects.

After the Introduction there follow some photographic illustrations, principally by A. F. Kersting, many of which are so brilliant that they add a new lustre to the architecture they illustrate. One would like especially to draw attention to the grand *façade* of Gibbs' St. Mary-le-Strand, (27A), to the photographs of Hawksmore's St. Anne's, Limehouse, and St. George in the East (32 and 33). Here is superb representation and magisterial design; indeed, it might be said of some of the photographs that they do some of the buildings a little more than justice—to mention one, the Tower of St. Luke's, Chelsea (62). Only is the inside of St. Stephen's, Walbrook, a little disappointing; it does not show the spaciousness of this great interior of Wren's. One other very fine photograph calls for special mention—namely, the north *façade* of St. Mary, Woolnoth, again by Hawksmore. To sum up, a glance through the illustrations could hardly fail to whet the appetite of the most casual *dilettante*.

After the illustrations the text is divided into 29 parts, taking the churches in the cities

of London and Westminster, and the 27 Boroughs, in alphabetical order. Of all of these churches individually the authors have briefly sketched the history, the architecture, and other general points of interest peculiar to each. It is all done in a lively and readable way, and with an obvious knowledge of the subject, clearly showing the immense amount of research carried out. Each little essay, ranging in length from five lines to many pages, brings vividly before one the 'life' of each church as a centre of human activity and religious use and teaching throughout the ages.

The book has a deeper significance than a mere illustrated historical outline of the many churches built in London up to 1830. It is a human document and shows the church as a living influence in the life of the nation. Small wonder was it that the authors were unable to find anything on the subject which entirely satisfied them and so decided to write a book themselves!

Architecture is a great historian, its study enables one to rub shoulders with the greatest creative artists of all times. No scientific humanist could achieve what is set before us in this book, it is a record of fine achievement and spiritual realities.

A. B. KNAPP-FISHER

FROM THE JOURNAL OF 1856

VOLUME IV. *14th November*, 1856

FEAR OF THE MACHINE

Part of an extract from an Address by Mr. Chadwick to the Philanthropic Congress at Brussels On Improvements in Machinery and in Manufacturing Processes, as Affecting the Condition of the Labourers.

'On the announcement of projects to introduce new machinery, immediate apprehensions are entertained of its effects on those whose labour is superseded. Economists, who are advocates for the use of machinery, urge in mitigation of its assumed effects, that its introduction is necessarily gradual. Entertaining such apprehensions myself, I was early prepared to consider, in poor law administration, measures of a special character for the relief of the labourers, whose services had been discontinued by the introduction of labour-saving machinery.

'In investigating the administration of relief in England, I looked with particular interest on some fields of extensive improvement in machinery and processes, for the destitute labourers and their families, who, as it might fairly be anticipated, must have been reduced to pauperism by such improvements, but, as a class, there was nowhere a trace of them, and the existence of particular cases from that cause on the pauper rolls was extremely doubtful. In one instance, where, by the introduction of Mr. Whitworth's street-sweeping machine into one large town district, the labour of the entire body of the sweepers by hand had been displaced, I confidently expected that that class, at least, who were of the lowest labourers, and the least capable of changing the object of their labour, would be found, as a class, on the destitute relief list; but, as a class, they were not there, and having obtained a list of them, I directed inquiries to be made into the individual cases, as to what had become of each of them. About 8 per cent of them had died. Considering the class, many of whom were old and feeble, this, for the time, was not a mortality beyond the average. Of about six per cent. of them no account could be got, but the rest had found other, and on the whole actually better paid work.

Some Activities of Other Societies and Organizations

MEETINGS

SAT. 10 NOV. Chemical Engineers, Institution of, College of Technology, Manchester. 3 p.m. H. Holdsworth : *Animal foodstuff plant—some considerations.*

Horniman Museum, London Road, S.E.23. 3.30 p.m. C. J. Dunn : *The Japanese Puppet Theatre.*

MON. 12 NOV. Electrical Engineers, Institution of, Savoy Place, W.C.2. 5 p.m. Discussion : *Power Factor in Industrial Installations.*

Geographical Society, Royal, Kensington Gore, S.W.7, 8.30 p.m. Lieutenant-Commander M. J. N. Foster, R.N. : *Operation 'Deepfreeze I.'*

Imperial Institute, S.W.7. 5.45 p.m. K. M. Gaul : *Antarctica.*

Junior Institution of Engineers, at the Engineer's Club, Albert Square, Manchester. 7.30 p.m. C. W. Drane : *Some Aspects of Industrial Water Treatment.*

TUES. 13 NOV. Analytical Chemistry, Society for, at the University, Birmingham, 3. 7 p.m. Discussion : *Laboratory Planning and Organisation.*

Manchester Geographical Society, 16 St. Mary's Parsonage, Manchester, 3. 6.30 p.m. Miss M. Benson : *Australia and New Zealand.*

Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 4.30 p.m. Symposium : *Research in Automobile Stability and Control.*

Metals, Institute of, at the Electricity Showrooms, Kingsway, Swansea. 6.45 p.m. C. A. J. Plummer : *Fuel.*

Textile Institute, at Messrs. Blount & Co., Ltd., Belper, Notts. 7.15 p.m. Dr. T. H. Morton : *The Properties of the New Textile Fibres.*

Works Managers, Institution of, at the Royal Society of Arts, W.C.2. 7.30 p.m. Admiral Sir Denys Boyd : *Leadership in Industry.*

WED. 14 NOV. Archaeological Institute, Royal, at the Society of Antiquaries, Burlington House, W.1. 5 p.m. J. T. Smith : *Mediaeval Roofs : a Classification.*

Chemical Engineers, Institution of, Midlands Institute, Paradise Street, Birmingham. 6.30 p.m. H. Saenger : *The transport, storage and handling of hydrochloric, nitric, and sulphuric acids.*

Engineering Inspection, Institution of, at the Royal Society of Arts, W.C.2. 6.45 p.m. M. J. Moroney : *Some Aspects of Statistical Quality Control.*

Eugenics Society, at the Royal Society, Burlington House, W.1. 5.30 p.m. Dr. J. A. H. Lee : *Some Problems Raised by the Regional Variations in Intellectual Ability in Britain.*

I.C.I. Merseyside Scientific Society, at the I.C.I. Widnes Laboratory, Lancs. 5.15 p.m. J. V. S. Glass : *Some Aspects of the Economics of the Heavy Chemical Industry.*

Newcomen Society, at the Science Museum, S.W.7. 5.30 p.m. Rex Wailes : *Norfolk Windmills ; Part II, Drainage Mills.*

Physical Society, at the Institute of Ophthalmology, Judd Street, W.C.1. 3.30 p.m. D. L. Simms : *Colour in Fire Research.*

Radio Engineers, British Institution of, at the Institution of Mining and Mechanical Engineers, Westgate Road, Newcastle-upon-Tyne. 6 p.m. A. M. Sutton : *Some Practical Aspects of Echo Sounding.*

Radio Engineers, British Institution of, at the Technical College, Wulfruna Street, Wolverhampton. 7.15 p.m. J. A. Sargrove : *The Automatic Factory.*

Textile Institute, at the Chemical Society, Burlington House, W.1. 7 p.m. Miss P. Garbutt : *Laundry and Dry Cleaning.*

Victoria & Albert Museum, S.W.7. 6.15 p.m. John Summerson : *St. Paul's Cathedral.*

THURS. 15 NOV. Building Centre, Store Street, W.C.1. 6 p.m. Leo De Syllas and Bernard Mountford : *Door and Window Furniture.*

Metals, Institute of, at the Engineering Society, 9 The Temple, Dale Street, Liverpool. 7 p.m. P. T. Houldcroft : *Some Metallurgical Aspects of Welding Non-Ferrous Metals.*

Physical Society, at the Institute of Laryngology and Otology, 330 Grays Inn Road, W.C.1. 5.30 p.m. Miss P. H. Strange : *Sensations of Pitch.*

Textile Institute, at the University College, Cathays Park, Cardiff. 7.15 p.m. R. H. Wright : *Modern Textile Designs and their Production.*

FRI. 16 NOV. Junior Institution of Engineers, 14 Rochester Row, S.W.1. 7 p.m. R. A. Hill : *Semi-Conductors and their Applications.*

Kinematograph Society, British, at the Lighting Service Bureau, Savoy Hill, W.C.2. 7.30 p.m. J. W. Hissey : 16mm. Film Presentation—*Film Handling.*

Mechanical Engineers, Institution of, 1 Birdcage Walk, S.W.1. 6 p.m. Dr. A. W. Crook : *Simulated Gear Tooth Contacts—Some Experiments upon their Lubrication and Subsurface Deformations.*

Meteorological Society, Royal, at the Conference Hall, County Hall, S.E.1. 5.30 p.m. N. Bradbury : *Aviation meteorology.*

Royal Institution, 31 Albemarle Street, W.1. 9 p.m. Professor I. A. Richmond : *Roman Military Engineering.*

SAT. 17 NOV. African Society, Royal, at the Royal Society of Arts, W.C.2. 10 a.m. to 5 p.m. Conference : *Africa.*

Horniman Museum, London Road, S.E.23. 3.30 p.m. Her Excellency the Begum Ikramullah : *Brief Survey of the Pakistani Cottage Industries.*

MON. 19 NOV. Imperial Institute, S.W.7. 5.45 p.m. J. Chinna Durai : *India.*

Metals, Institute of, at the University, St. George's Square, Sheffield, 1. 7.30 p.m. Dr. H. D. Turner : *Automation.*

Transport, Institute of, at 66 Portland Place, W.1. 5.45 p.m. S. G. Hearn : *The Outlook in Modern Railway Operation.*

TUES. 20 NOV. Electrical Engineers, Institution of, Savoy Place, W.C.2. 5 p.m. Discussion : *Data Processing Equipment for Experimental Work ; A Review of Techniques and Methods.*

Industrial Transport Association, at the Royal Society of Arts, W.C.2. 6.30 p.m. W. F. Griffiths : *Southampton Docks Development.*

Manchester Geographical Society, 16 St. Mary's Parsonage, Manchester, 3. 6.30 p.m. J. R. Hulme : *Cyprus and Syria.*

Petroleum, Institute, 26 Portland Place, W.1. 6 p.m. K. T. Woodard : *An Introduction to Electronic Accounting in the Petroleum Industry.*

WED. 21 NOV. Chemical Engineers, Institution of, the University, Leeds. 7 p.m. E. G. Richardson : *Non-Newtonian Fluids.*

Electrical Association for Women, at the Institution of Electrical Engineers, Savoy Place, W.C.2. 2.15 p.m. Discussion : *Planning for Light.*

Electrical Engineers, Institution of, Savoy Place, W.C.2. 5 p.m. Discussion : *Aluminium Conductor Cables.*

Folk-Lore Society, at the University College, Gower Street, W.C.1. 7.30 p.m. Dr. C. H. Talbot : *English Political Prophecies.*

Kinematograph Society, British, at the Royal Society of Arts, W.C.2. 7.15 p.m. T. Robinson : *The Projectomatic System.*

Locomotive Engineers, Institution of, at the Institution of Mechanical Engineers, 1 Birdcage Walk, S.W.1. 5.30 p.m. Symposium : *Training of Locomotive Engineers.*

Metals, Institute of, at the Central Library, Manchester. 6.30 p.m. D. McLean : *The Rôle of Grain Boundaries in Creep.*

Meteorological Society, Royal, 49 Cromwell Road, S.W.7. 5 p.m. Discussion : *Climatic change with special reference to the period of the instrumental record.*

Numismatic Society, Royal, at the Society of antiquaries, Burlington House, W.1. 5.30 p.m. Derek F. Allen : *Coins of the Brigantes, the Coritani and the Dobunni.*

Textile Institute, at the Arms Hotel, Macclesfield. H. W. Partridge : *The Scientist in the Textile Industry.*

Victoria & Albert Museum, S.W.7. 6.15 p.m. Trenchard Cox : *David Cox.*

THURS. 22 NOV. Chadwick Trust, at the Royal Society of Health, 90 Buckingham Palace Road, S.W.1. 5.30 p.m. Dr. P. A. Raffle : *The Health of the Worker.*

Engineering Designers, Institution of, 38 Portland Place, W.1. 6.45 p.m. Frank G. Woollard : *Automation and the Designer.*

King's College, London, Strand, W.C.2. 5.30 p.m. Professor A. H. Wilson : *Diderot and the Enlightenment.*

FRI. 23 NOV. Radio Engineers, British Institution of, at the University of Edinburgh. 7 p.m. L. C. Stenning, Dr. P. Jones and P. Holroyd : *Information Theory.*

Royal Institution, 21 Albemarle Street, W.1. 9 p.m. Professor R. L. Wain : *Plant Growth and Man-made Molecules.*

SAT. 24 NOV. Horniman Museum, London Road, S.E.23. 3.30 p.m. G. R. G. Worcester : *Sail and Sweep on the Upper Yangtze.*

OTHER ACTIVITIES

NOW UNTIL 18 NOV. Imperial Institute, S.W.7. Ivan Payne : *Exhibition of Paintings.*